CALCIUM CARBONATE FORMATION IN FLUIDIZED BED PELLET REACTORS TO REDUCE Ca, U AND DOC IN DRINKING WATER (UPPSALA, SWEDEN)

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Pellet softening technique by using fluidized bed pellet reactors is applied to reduce the hardness of drinking water about up to 50 % (e. g. HOFMAN et al., 2007). Uranium and dissolved organic carbon (DOC) concentrations are also significantly lowered due to the above treatment, but until now quotations and mechanisms for U and DOC reduction are not revealed.

Pellet softening is based on the addition of slaked lime into a reactor containing water and quartz pellets. Accordingly, dissolved calcium and carbonate ions precipitate mostly on the quartz grains. The pellets covered with $CaCO_3$ and additional suspended solids are separated from the water within a continuous process. This overall treatment results in

(i) Ca reduction up to 64 % (from 92 down to 34 mg L^{-1} of Ca),
(ii) SIcalcite decrease from 0.7 to 0.2,
(iii) Decrease of U content up to 23 % (from 0.022 down to 0.017 mg L^{-1}), and
(iv) DOC reduction of up to 14 % (from 3.6 down to 3.1 mg L^{-1}).

XRD, IR and Raman pattern indicate calcite as precipitate. In some cases low-magnesium calcite was observed, but no aragonite occurs. The U concentration of the bulk carbonate scaling ranges from 1 to 12 mg kg^{-1} in the $CaCO_3$ covering, but can even reach 90 mg kg^{-1} in the $CaCO_3$ sludge, which is rich in TOC (up to 13 %). Elemental zoning of U, Mg etc. throughout calcite horizons could not be identified by both LA-ICP-MS and Micro-Raman spectroscopy.

It is well known that U is incorporated in $CaCO_3$ (REEDER et al., 2001), but it can also form complexes with DOC, such as humic acids (e.g. RANVILLE et al., 2007). In the present study ultrafiltration was used to investigate aquo complex formation of U with DOC to quantify the amount of DOC-bounded U. In an experimental approach a correlation between U and DOC content was observed in the filtrated solutions, where at 30 kDa the U and DOC concentrations are reduced up to 40 and 15 %, respectively.

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